State of California

Department of Health Services

Memorandum

To : Anthony J. Landis, P. E., Chief
Site Mitigation Unit
Northern California Section, Sacramento

Date : April 10, 1985

Subject : Initial Assessment Study of Naval Weapons Center China Lake, CA. Phase I of the Navy Assessment and Control of Industrial Pollutants (NACIP) Program

From : Kevin L. Shaddy
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I have reviewed the Initial Assessment Study (IAS) which was completed in November of 1984 and transmitted to the Department of Health Services (DOHS) on January 8, 1985.

The IAS identified 42 potentially contaminated sites at China Lake Naval Weapons Center (CLNWC). Each of the sites were evaluated with regard to contamination characteristics, migration pathways, and pollutant receptors using an evaluation tool called the Confirmation Study Ranking System (CSRS). The 42 sites were rated using the CSRS model which assigns a value that ranges from 0 to 100. A "0" means no potential hazard and a 100 indicates a high probability of severe hazard to humans or environmental resources. Of the 42 sites: two sites were eliminated due to the fact that mitigation projects have already been undertaken; 26 sites were assigned "0" ratings because one of the three rating factors was equated to "0" which, based on the model, eliminates any potential for adverse environmental impact; 14 sites received ratings between 2.5 and 12.4, which indicates that no immediate threat exists to human health or the environment, but that a further evaluation step called a confirmation study is warranted. Enclosed as Attachment "A" is a brief summary of the information presented for each of the 42 sites. (Chapter 8 of the NACIP report).

Although individual factor scores are not provided, the descriptions indicate that of the 26 sites that were assigned "0" ratings: nine were given "0" ratings due to a lack of hazardous contaminants; four appear to have been assigned "0" ratings due to no migration potential; 11 were assigned "0" ratings based on no receptors in addition to a low migration potential; and two were eliminated due to low migration potential and small hazardous waste quantities. Based upon the information that is provided, the elimination of 12 of the 26 sites from further study appears to be appropriate. Included in these 12 are: nine sites (19,20,24,25,26,37,38,40,42) that were eliminated because they received only inert waste; two sites (9,35) that were eliminated due to no migration potential and/or small waste quantity; and one site (30) that was found to contain only live ordinance contamination with minimal migration potential. The information in the report indicates that the remaining 14 sites should not have been eliminated from further study. These 14 sites can be placed in two categories; those that need confirmation studies, and those that need additional review.

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From the information that we have, it appears that five sites (4,10,33,36,39) need additional review. The following is a brief summary of why these sites need additional review:

Site 4, Beryllium - Contaminated Equipment Disposal Area.

It is stated that it is unlikely that any detectable amounts of beryllium residue remain at this site. If this can be subtantiated then elimination of this site would probably be justifiable. If this cannot be substantiated by review, soil saampling will be necessary to confirm the absence of detectable amounts of beryllium.

Site 10, Salt Wells Disposal Trenches.

An estimate of the total volume of waste disposed of at this site is given. This estimate is not broken down to indicate the volume of solvents and liquid chemicals that were disposed of at this site. If the volume of solvents and liquid chemicals can be demonstrated as being very small, then eliminated of this site from further study would be reasonable. If this volume is not verifiable as being very small, a confirmation study will be necessary.

Site 33, Michelson Laboratory Dry Wells.

Small quantities of battery acid were disposed of at this site which on their own probably would not present a problem. No mention is made of possible lead contamination of this acid. This should be reviewed. If lead contamination is confirmable, then this site should be evaluated based upon this contamination.

Site 36, Snort Storage Sheds.

Liquid chemicals including: fuming nitric acid, unsymmetrical dimethyl hydrazene, furfal alcohol, and analine were reportedly spilled onto the ground at this site. A total of 300 gallons were reportedly spilled at this site, however no indication is given as to the size of the area onto which these materials were spilled. Additionally, it is stated that it is expected that 70% of these materials volatilized on the soil surface. If the area on which the chemicals were spilled can be verified as being large and the 70% volatilization can also be verified, then elimination of this site may be justifiable. However, if these things cannot be demonstrated, a confirmation study will be necessary.

Site 39, CGEH-1 Geothermal Waste.

This site was closed in 1979 in accordance with Regional Water Quality

Control Board guidelines. No information is given about these guidelines. If it can be demonstrated that the closure was adequate by today's standards, then elimination of this site from further study would be appropriate. If the closure was not adequate, then a confirmation study will be necessary.

The information in the report indicates that nine sites (5,6,8,11,18,21,23,28,41) that were eliminated from further study actually need confirmation studies. The following is a brief summary of why these sites should not be eliminated from further study.

Site 5, Burro Canyon.

During periods of heavy rain, surface flooding and runoff is possible. This runoff could transport contaminants towards Indian Wells Valley. Both surface and subsurface soil samples should be obtained and analyzed for all potential contaminants at this site. If contamination is found at high levels or at depth, water sampling may be necessary.

Site 6, T-Range Disposal Area.

Waste disposed of at this site was first burned; any residue or waste remaining after burning was buried. An assumption is made that groundwater is more than 100 feet deep at this site. Based upon this assumption and the fact that groundwater in the area contains TDS in excess of 20,000 ppm, this site was eliminated from further study. The reasoning used is that migration potential is small and even if migration does occur, the water that will be effected is not usable. This site needs additional work to verify the actual concentration of residual contaminants in soil and the groundwater parameters.

Site 8, Salt Wells Drainage Channels.

Over a 30-year period 14,150 gallons per day of liquid wastes were discharged to open drainage channels. These wastes included ammonium perchlorate, TNT-washwater, and isocyanates. TNT contaminated water reportedly breaks down to nitrates and toluene. Depending on the geohydrology of the area, groundwater could be as shallow as 50 feet. The report assumes that groundwater is relatively deep. The fact that groundwater under the site contains 20,000 ppm TDS is cited as a reason for eliminating this site from further study. Due to the large quantity of waste disposed of at this site and the uncertainty about the groundwater parameters, a confirmation study should be undertaken at this site.

Site 11, China Lake Propulsion Laboratory (CLPL) Evaporation Ponds.

The site consists of two unlined ponds which received an unknown volume of RDX and AP washwater, and some powdered metals. The report states that the groundwater gradient could be either northeast or southwest depending on the location of a divide. If the gradient is to the southwest, the report indicates that it would take 300 years to reach well supplies. This site needs a confirmation study.

Site 18, China Lake Propulsion Laboratory (CLPL) Leach Fields.

Approximately 7,500 gallons per day of waste water containing phosphates, sulfides, dilute TDX and TNT, TCE, oil, grease, ammonia, dilute propellants and photo laboratory waste chemicals were discharged to three leachfields at this site. The groundwater situation at this site is similar to that at Site 11 above. This site needs a confirmation study.

Site 21, CT-4 Disposal Area.

Approximately 2,000 cu. yards of PEP materials, depleted uranium, radium dials, wood, concrete, metal, plastics, cans and barrels, some of which contained residual chemicals, solvents and oils were buried in a 200 foot long by 50 foot wide and 20 foot deep ditch. No estimate of volume is provided for the hazardous and liquid hazardous wastes disposed of at this site. This site needs a confirmation study.

Site 23, K-2 South Disposal Area.

This area consists of three slit trenches that received demolition debris, bomb casings, concrete, wood, metals and most importantly 17,000 gallons of chlordane in one-and five-gallon metal containers on a one-time basis. The chlordane is two percent technical chlordane together with 98 percent kerosene. This site is dismissed from further investigation due to limited migration potential and no receptors. This site definitely needs a confirmation study. The chlordane should be excavated and properly disposed of.

Site 28, Old DPDO Storage Yard.

From about 1965 to 1970 this site was used for the storage of used, leaking, transformers and capacitors. This site was abandoned in 1970. The report states that there is no evidence of PCB spills at this site. A confirmation study should be undertaken at this site in order to determine if PCB contamination is present.

Site 41, Ransburg Wash #2.

Fairly large quantities (2000-3000 gallons each) of waste oils and solvents were disposed of at this site. Burning is stated to have occurred in the 1950's and early 1960's; however, this site was in operation until 1980. The volumes of waste oil and solvents may have been large between the mid 1960's and 1980. A confirmation study is needed at this site.

Sites Recommended for Confirmation Studies

The Initial Assessment study concludes that confirmation studies are appropriate and warranted for 14 sites (3,7,12,13,14,15,16,17,22,27,29,31, 32,34). Recommendations on the type of confirmation work that should be undertaken at each of the 14 sites are given.

The biggest objection that I have to the confirmation work as outlined in the report is the recommended frequency and duration of groundwater sampling.The recommended confirmation work at eight sites (12,14,15,16,17,22,27,34) consists solely of groundwater sampling on a quarterly basis, for one year. This approach amounts to a short-term sampling plan for sites that require either long-term monitoring or extensive soil analysis work. In many cases, i.e., large landfills that received a wide variety of non-hazardous as well as hazardous wastes, it is not economically feasible to do extensive soil analysis; therefore, long-term groundwater monitoring becomes necessary. In situations where no contaminants are detected at the start of a project, it is reasonable to reduce the frequency of sampling while increasing the duration of the project. If at any time contaminants are detected, this frequency can then be increased.

The following is a brief summary of the changes that I think are necessary in the recommended confirmation work for these 14 sites:

Site 3, Armitage Field Leach Pond.

If the soil samples indicate the presence of significant residual contamination, the duration of the groundwater sampling program should be expanded, unless, soil removal is undertaken.

Site 7, Michelsen Laboratory Drainage Ditches.

Cyanide should be added to the list of testing parameters. If the soil samples indicate the presence of significant residual contamination, the duration of the groundwater sampling program should be expanded, unless, soil removal is undertaken.

Site 12, Snort Road Landfill.

The duration of the groundwater sampling program should be expanded. The frequency should be adjusted based upon the analytical results. If adequate soil sampling is done, this may not be necessary.

Site 13, Oily Waste Disposal Area.

At least one boring should be advanced in each of the two trenches. If the oil that was disposed of was used oil, then metals should be added to the testing parameters. EPA method 601 should be added to look for TCE. Based upon the soil analysis results, the duration of the groundwater sampling program may need to be expanded.

Site 14, ER Range Septic System.

See Site 12.

Site 15, R Range Leach Field.

See Site 12.

Site 16, G-1 Range Septic System.

See Site 12.

Site 17, G-2 Range Septic System.

See Site 12.

Site 22, Pilot Plant Road Landfill.

See Site 12.

Site 27, NAF Disposal Area.

See Site 12. Also, add solvents to the testing parameters.

Site 29, C-1 East Disposal Area.

See Site 12. Also, the chlordane should be excavated and properly disposed of.

Site 31, Public Works Pesticide Rinse Area.

The possibility of solvent contamination should be examined. Based on soil results, groundwater sampling may be necessary.

Site 32, Golf Course Pesticide Rinse Area.

The possibility of solvent contamination should be examined.

Site 34, Lauritsen Road Landfill.

See Site 12.

Conclusions and Recommendations

Of the 28 sites that were eliminated from the confirmation phase of the NACIP program, 14 appear to have been eliminated for justifiable reasons. These reasons range from a lack of hazardous waste disposal at nine sites (19,20,24,25,26,37,38,40,42) to the fact that confirmation and mitigation work have already been undertaken at sites 1 and 2.

The remaining 14 sites fall into two categories; those that need confirmation studies and those that need additional review in order to verify some of the assumptions and facts that are stated in the report. Based on the information in the report, there are five sites (4,10,33,36,39) that need additional review and nine sites (5,6,8,11,18,21,23,24,41) that should definiately be included in the confirmation phase.

Unless CLNWC can produce additional information that supports the elimination of these sites from further study, we should require the inclusion of all 14 in the confirmation phase of the NACIP program.

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"ATTACHMENT "A"

CHAPTER 8. DISPOSAL SITES AND POTENTIALLY CONTAMINATED AREAS

As a result of onsite surveys, personnel interviews and historic records review, the IAS team identified a total of 42 disposal sites and potential contaminated areas at NAVWPNCEN China Lake. This chapter describes the sites with regard to the physical character and location, the type and quantity of wastes and the migration pathways of the contaminants in the soil and ground water. Figures 2-1, 2-2, 2-3, and 2-4 in Chapter 2 show the locations of all disposal sites at NAVWPNCEN China Lake. Figure 8-1 shows the key sites and receptors along with general flow patterns and migration pathways.

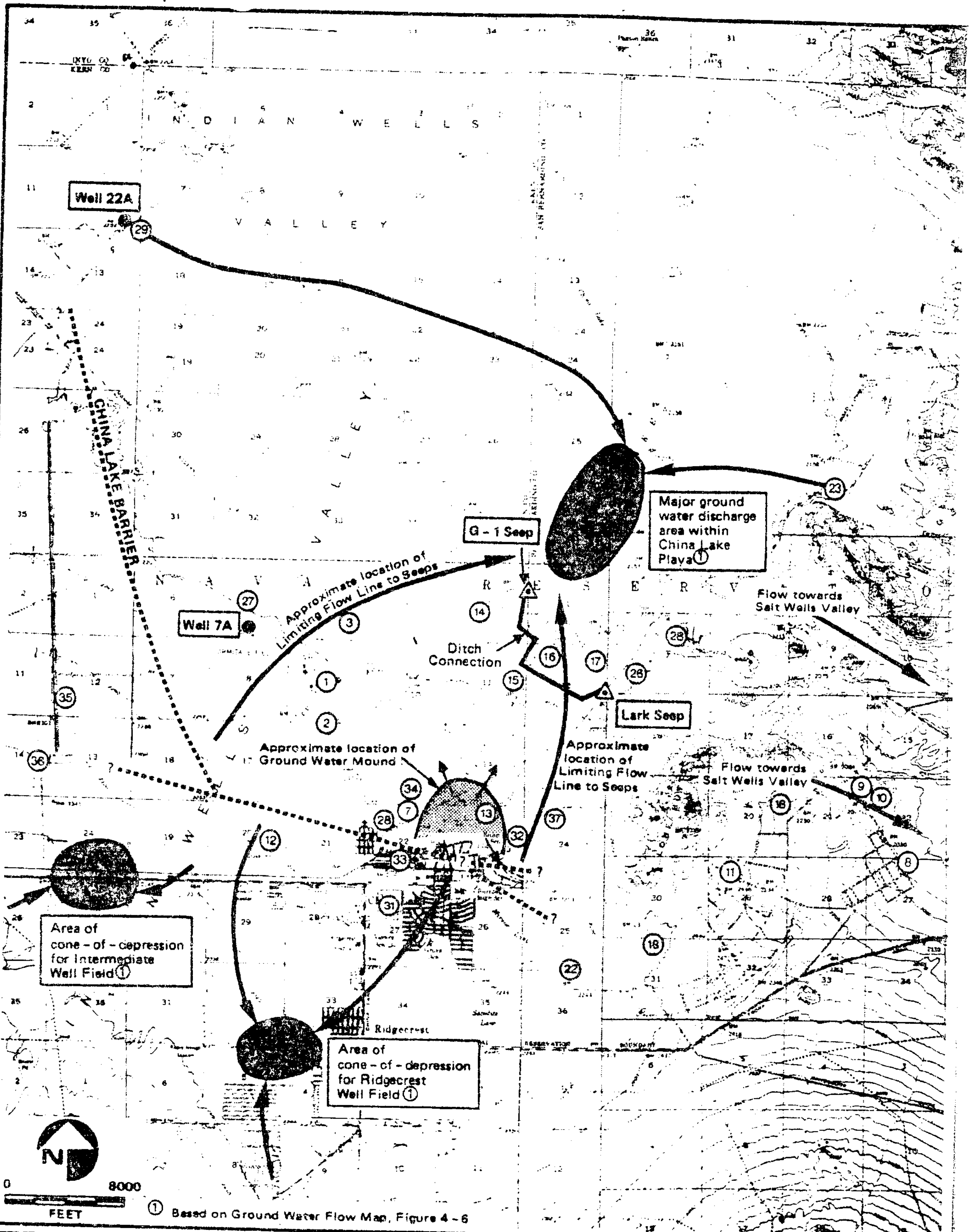
8.1 SITE 1, ARMITAGE FIELD DRY WELLS. From 1945, when Armitage Field was constructed, to 1982, substandard jet fuels (JP-4 and JP-5) and used engine oils were disposed of at the fuel farm area into six (6) dry wells (see Figure 8-2). These disposal methods were discontinued in 1982 when the Lahontan Regional Waste Quality Control Board expressed concern over whether these operations were affecting the quality of ground water in the area. The Navy subsequently authorized several investigations to determine the nature and extent of contamination from these wells and to recommend necessary remedial actions (see ERTEC Western, 1982; ERTEC Western, 1983; and Leedshill-Herkenhoff, 1983). ERTEC Western, estimated that approximately 1,000,000 gallons of waste fuel was disposed of in these dry wells over the 37-year period. Leedshill (1983) determined that 8000 gallons of fuel was disposed of each year in 1981 and 1982. Depth of the dry wells is about 10 feet.

Armitage Field is located on sediments composed primarily of alluvial fan and slope wash deposits, and to a lesser extent on old playa deposits. The upper 25 feet of the site typically consists of brown, calcareous silty sands and sandy silts. Underlying this formation is an old playa lakebed composed of gray sandy plastic clay. Below the old playa deposits in the fuel farm area are clean sands grading to clayey sands to a depth of approximately 40 feet. A layer of relatively clean, fine to coarse sand underlies the playa deposit.

In the fuel farm area, the depth to the water table is generally at about 30 feet and occurs in the clean sands and clayey sands below the old playa deposits. The direction of ground water flow is northeasterly, towards the lower China Lake playa. Locally, the slope of the water-table surface or ground water gradient is 0.0015 feet per foot.

According to Leedshill-Herkenhoff (1983) the porosity of dense clean sands and clayey sands is assumed to be between 0.20 and 0.40 and the average linear ground water velocity at the fuel farm area is between 7 and 45 feet per year toward the northeast.

An assessment of fuel in the ground water underlying the Armitage Field area was conducted for the Navy by Leedshill-Herkenhoff in 1983. For this assessment, a total of 11 soil borings were placed in the fuel farm area, 8 of which were converted to observation wells. Three wells encountered measurable free floating fuel above the water table. Organic vapor readings taken on soil samples collected at approximately the depth of the water table indicated high organic vapor concentrations in three other borings.



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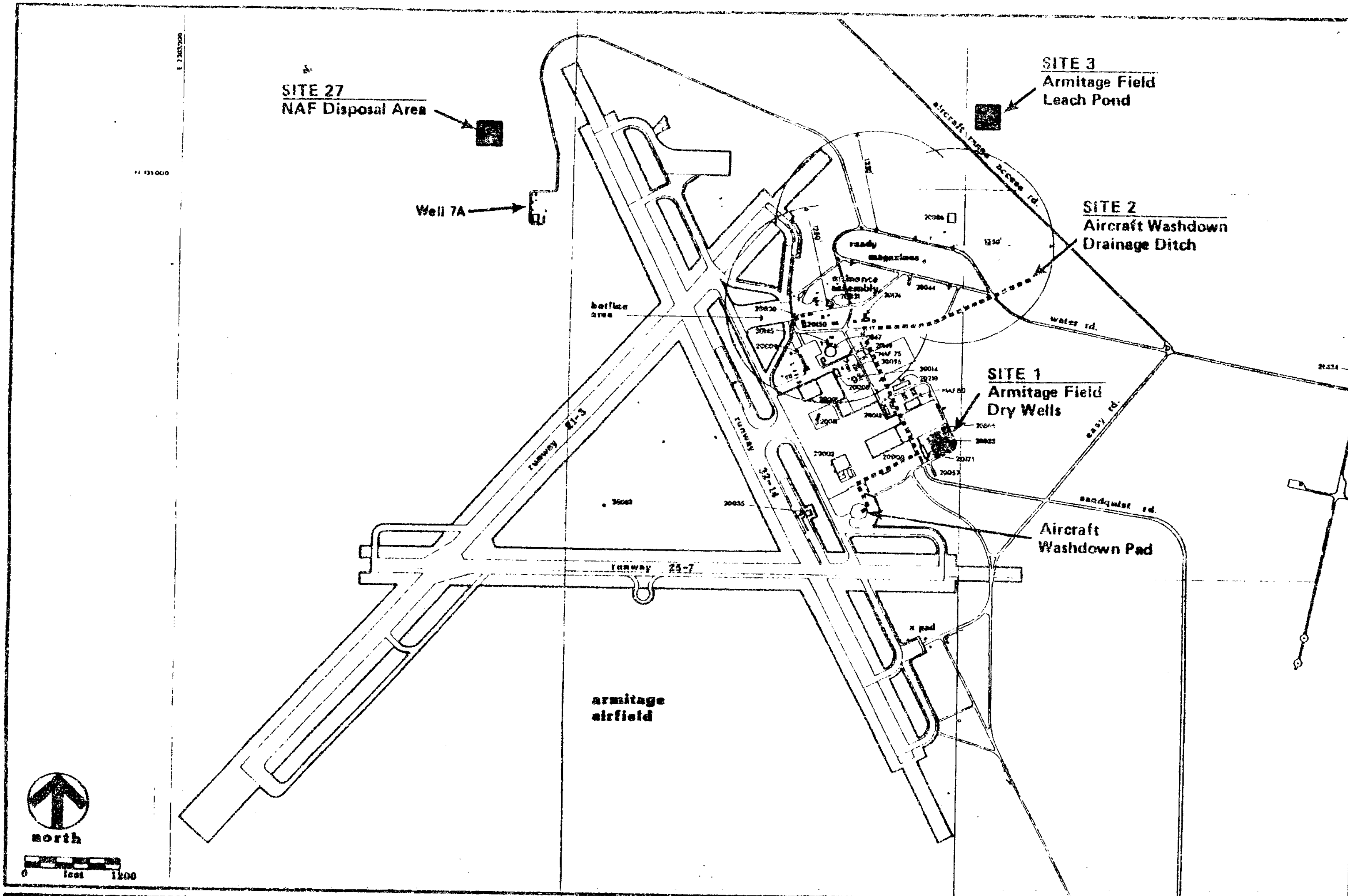
Key Sites Relative to Migration Pathways and Receptors

FIGURE 8-1



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Armitage Field Disposal Sites

FIGURE 8-2

This assessment also determined that fuel occurs in clean sands and clayey sands located below the old playa clay deposits. A maximum observed fuel thickness of 2.50 feet was found in one boring and 3.6 feet in a second boring. It was assumed by Leedshill (1983) that between 20,000 and 70,000 gallons of fuel are presently below the fuel farm area. Furthermore, the quality of fuel in the soil and ground water does not appear to have degraded since being placed in the ground.

The main area of ground water pumpage within Indian Wells Valley is located approximately 3 miles southwest of the fuel farm, which is up gradient in the regional ground water system from the potential contamination sources. Water-quality data indicates that the ground water in this area is potentially usable for most purposes. In addition to the well fields in Indian Wells Valley (Figure 8-1), a water well is located just 1 mile northwest of this site. Although not presently used, this well could be a potential source of water supply. Migration from this site also is in the direction of the seeps containing the Mohave chub. This is shown in Figure 8-1. Presently mitigation measures are being contracted out by NAVWPNCEN China Lake to clean up the contaminated ground water and soils.

8.2 SITE 2, AIRCRAFT WASHDOWN DRAINAGE DITCHES. From 1945 to 1982, used engine fluids and wash water containing detergents and degreasers generated by aircraft cleaning and equipment maintenance at Armitage Field were disposed of in unlined ditches (see Figure 8-2). The aircraft cleaning area is a 200-foot diameter pad located west of Runway 32-14 and south of Building 20002. In 1981 a wastewater collection system and oil-water separator was installed at Armitage Field. Prior to 1981, all aircraft washwater and waste fuels were drained from the aircraft cleaning pad to an open unlined ditch which eventually drained to an open field east of Armitage Field. Although it can be assumed that some wastewater evaporated, certain amounts of the wastewater did percolate into the soil underlying the ditch. This open ditch also served as the stormwater drainage system for Armitage Field and this stormwater ultimately diluted the aircraft washwater flow. The compounds that contaminated the wastewater from the washing and maintenance operations included chlorohydrocarbon degreasers, industrial detergents, hydraulic fluids, lube oil, antifreeze and jet fuels. Approximately 10,000 to 20,000 gallons per day (gpd) of wastewater containing aircraft washwater detergents, solvents such as TCE, oils and grease, and jet fuel were discharged to this open ditch. This production rate indicates that 0.25 to 0.5 million gallons of wastewater were released in 27 years (assumes 260 work days per year). If 0.5 percent of this wastewater was contaminant then 1400 to 2700 gallons of contaminant were released to the ditches. Combined with the washwater discharge was about 1000 gpd of boiler blowdown water containing phosphates, sodium sulfides and tannins from Boiler Plant #3.

The soil conditions and migration potential for the area are the same as that discussed under Section 8.1, Armitage Field Dry Wells. Confirmation well borings were drilled by Leedshill-Herkenhoff (1983) in the drainage ditches which confirmed the presence of TCE and fuel in the ground water. This site is undergoing remedial action under the same program as Site 1.

8.3 SITE 3, ARMITAGE FIELD LEACH POND. From 1950 to 1981, sanitary and industrial wastes from Armitage Field operations were disposed of to a central sewer system which conveyed the wastewater to an Imhoff (settling) tank. Effluent from the Imhoff tank flowed to an evaporation/leach pond located on the northeast side of Aircraft Range Access Road (see Figure 8-2). The average daily flow to the leach pond was determined to be about 17,000 gallons per day (gpd) (Lowry, 1978). The waste generated by Armitage Field was predominately domestic sewage. The amount of industrial waste discharged to the sewer system was relatively small with concentrations of metal and oil and grease being low. However, the wash area in Building 20011 discharged nearly 500 gpd of wastewater containing solvents, detergents and oil and grease to the sanitary sewer.

An analysis of effluent to the leach pond showed virtually no reduction in volatile suspended solids from the Imhoff tank influent (Lowry, 1978). It can be assumed that, over a 31-year operational period, the leach pond received approximately 130,000 gallons per year of wastewater containing solvents such as TCE, detergents, and oil and grease contaminants. Assuming only 0.5 percent of the wastewater flow was contaminant then 20,000 gallons of contaminant were discharged.

The migration potential for this leach pond site is the same as that described for Section 8.1, Armitage Field Dry Wells. Based on the Armitage Field migration potential assessment, contaminants from the leach pond would migrate downward into the ground water and towards the seep area. The contaminants include solvents, oils, and grease. These contaminants range from very low to very high mobility. For example, oil may be adsorbed readily in the unsaturated zone, but solvents are very mobile. The travel time for some of the solvents that could migrate from the source to the seeps is on the order of 50 to 100 years.

8.4 SITE 4, BERYLLIUM-CONTAMINATED EQUIPMENT DISPOSAL AREA. During the early 1960s, experiments were conducted on beryllium-based propellants in the Salt Wells Lab area. By 1965 the experiments stopped, all beryllium-contaminated equipment and the structure housing the experiments was burned and buried at Site 4. The site is located in the northeast quarter of Section 2, T26R, R41E in the Salt Wells Valley (see Figure 2-3 in Chapter 2). It has been reported by former NAVWPNCEN employees involved in these experiments that no bulk beryllium was buried at the site. The volume of burned equipment and solid waste material was estimated to be about 900 cubic yards. The amount of beryllium-contaminated equipment that may have been burned could not be determined.

Surficial soils under the site are very sandy and bedrock is probably 25 to 50 feet below the land surface. The bedrock is exposed both north and south of the site, and faults are probably present at or near the bedrock/valley fill contact. The depth to ground water is estimated to be greater than 100 to 200 feet and therefore would be within the fractured bedrock system. It is assumed that ground water quality is poor due to high salinity. At times, there may be water at the soil/bedrock contact. In general, the surface and ground water directions are to the southeast, toward the center portion of Salt Wells Valley which is approximately 4 miles away. In summary, it is unlikely that any detectable amounts of beryllium residue remain at this time. Noting that beryllium is highly adsorbed in the soil and that the water table is very deep, the potential for contaminant migration is small.

8.5 SITE 5, BURRO CANYON. From 1968 to about 1979, hazardous waste chemicals were delivered to Burro Canyon and disposed of by burning and detonation (see Figure 2-2 in Chapter 2). Burro Canyon was commonly used to burn and destroy

PEP materials such as TNT, compound B, and vinyl compounds. Unknown non-PEP hazardous chemicals were brought to the site and burned with the PEP materials (Ertec, 1982). It is estimated that about 3 tons of these hazardous chemicals a year were burned at this site. A total of 1200 cubic yards of these waste materials is reported to have been burned over an 11-year period. There is no data available indicating an amount of unburned material that may be present in the soil. Metal scrap, ash and other residue material are still visible at the surface of the site. Burro Canyon continues to be used for the disposal and burning of some PEP-type materials; however, no additional non-PEP hazardous waste materials are delivered to the site.

The Burro Canyon site is located within a deep granitic canyon. The soils consist primarily of course sands and alluvial deposits that include size fractions up to large boulders. Depth to bedrock is reported at 300 feet and the water table is below the bedrock/unconsolidated interface. It is assumed that ground water within the fractured bedrock or at the above mentioned interface, flows westerly towards North Lake Playa. Surface water drains west towards North Lake Playa. During periods of heavy rain the site has the potential for surface flooding.

The main potential mechanism for contaminates migrating from this site appears to be from surface flooding. Infrequent flood waters which inundate the site could transport contaminants towards Indian Wells Valley. However, the concentration of contaminants in the flood waters would be insignificantly low if present at all. Therefore it is highly unlikely that the ground water system under Indian Wells Valley would be contaminated from Burro Canyon flood waters.

8.6 SITE 6, T-RANGE DISPOSAL AREA. The T-Range disposal area consists of two open trenches and an air curtain incinerator all of which are currently still in operation. Past operations included the disposal of wastes in nine trenches, all of which are now closed. From 1946 to 1975 this range site was used to dispose of PEP materials, explosive-contaminated waste trash (hexane-laden with propellant) and hydrazene from the Salt Wells Lab area (see Figure 2-3 in Chapter 2). The primary method of disposal was by open burning of wastes, after which waste residuals were buried in open trenches. The nine (9) slit trenches, measuring 100 feet long by 12 feet wide and 7 feet deep, were used. Estimates show that during an average month approximately 2750 gallons of hydrazene, 500 pounds of high explosives, 1500 pounds of other PEP materials, along with some live ordnance, were burned at this site. Any explosions were accidental. An air curtain incinerator is used in the burning of some waste materials. Any residue and wastes remaining from the burning operation are buried in the adjacent trenches.

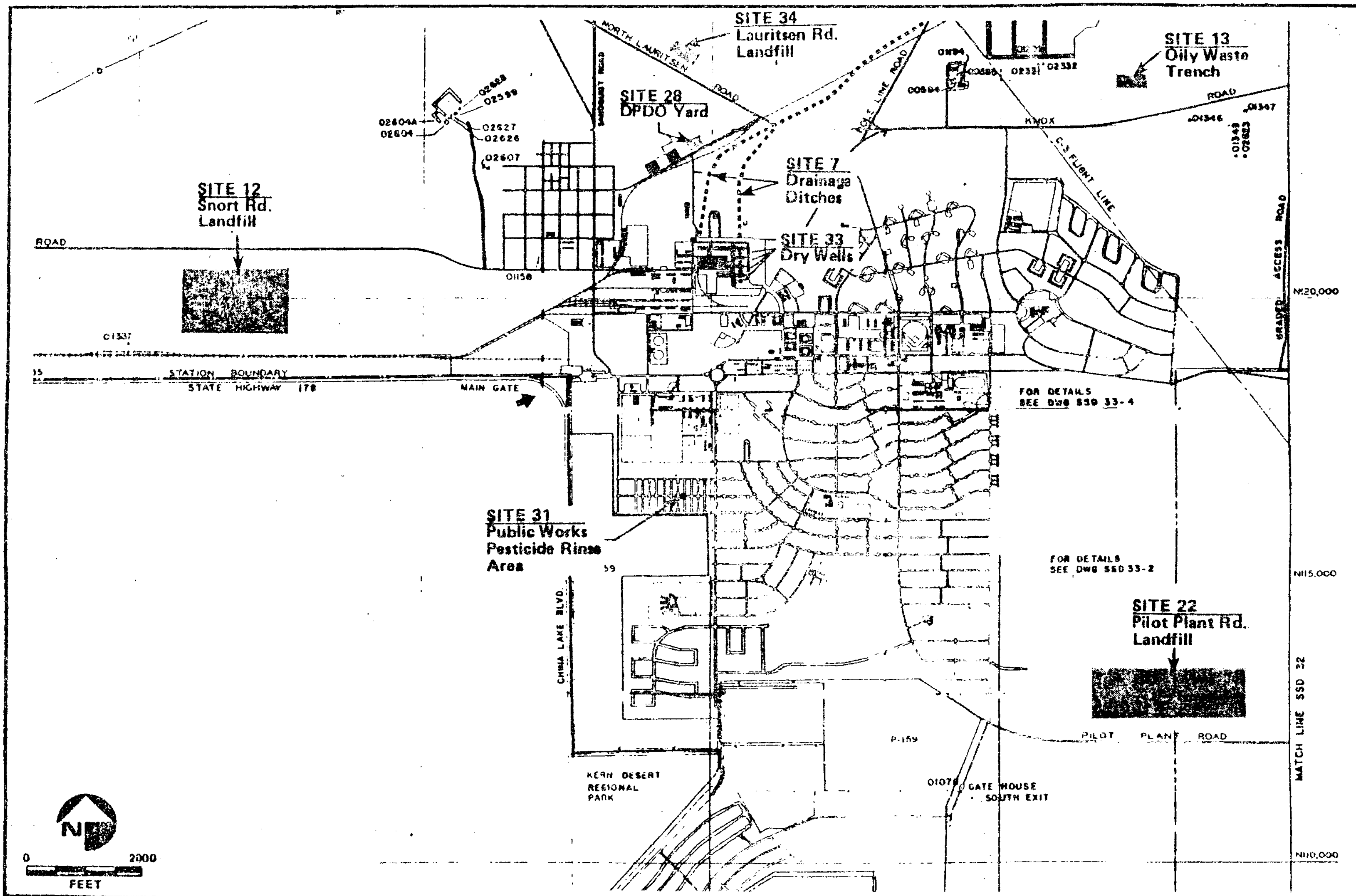
The surficial material at this site is sandy with many rock outcrops scattered throughout the area. Depth to bedrock has been reported to range between 50 and 100 feet and ground water is below the bedrock divide. This bedrock surface slopes toward the south and southeast direction. Ground and surface water flow locally toward Salts Wells Valley. According to data from the U.S. Geological Survey, the ground water is thought to be saline with total dissolved solids (TDS) in excess of 20,000 parts per million. Based on the assumption that ground water is more than 100 feet below surface, the potential for contaminate migration to the ground water is small. If contaminants reached the ground water, the migration would be to Salt Wells Valley which is a highly saline, unuseable water source.

8.7 SITE 7, MICHELSON LABORATORY DRAINAGE DITCHES. From 1947 to 1981, acid and chemical wastes were discharged from the Michelson Laboratory to two unlined drainage ditches. The ditches ran in a northeast direction from the lab (see Figure 8-3). The western most ditch ran for a distance of 1-3 miles and discharged into an open area. The longer and more western ditch received wastes from the plating/etching machine shops and the photographic shops. This ditch received primarily acids, heavy metals, cyanides and TCE. The eastern ditch, which ran only 0.5-1 mile in length, served the research labs and, as such, received various types of lab chemical wastes. It has been reported that the small east ditch had a flow rate of approximately 9400 gallons per day (gpd) while the west ditch had a flow of 62,000 gpd. Chapter 5 provides an inventory of wastewater sources, volumes, and chemicals discharged from Michelson Lab to the west and east drainage ditches.

The surficial soils in the area of Michelson Laboratory are reported as silty sands. These sands overlie the confining layer which is clay. Ground water occurs in unconfined conditions above the clay layer and in confined conditions below the clay. The depth to ground water is from 20 to 60 feet below the surface. In general, ground water flows to the north towards China Lake Playa and the seeps, which are about 2 miles to the northeast. However, leaking sewers, vegetation irrigation, and seepage from sewage evaporation ponds is providing substantial recharge to the ground water. Because of this increased recharge, a ground water mound has resulted which can cause localized flow patterns to change from the north to the south, east, and west directions. This may result in water in the shallow aquifer to flow across the clay barrier toward the water well fields in Ridgecrest.

The Navy has recognized the potential of contaminant migration from the Michelson Laboratory drainage ditches. This has been documented by Ertec (1983) and Engineers Testing Laboratories (1981). However, data gathered to date is inadequate for verification purposes. Detection limits for many analyses conducted are too high by today's standards.

8.8 SITE 8, SALT WELLS DRAINAGE CHANNELS. The Salt Wells laboratory complex consists of 20 small, individual facilities located in Section 21, 22, 27, and 28 of T26S R41E in the Salt Wells Valley (see Figure 8-4). From 1946 to 1981 wastewater from the labs was discharged to open drainage channels. In 1981 clay-lined evaporation ponds were constructed in place of unlined ponds. It has been suggested that wastewater in the drainage channels percolated into the soils and to the ground water (Ertec, 1982). The chemical wastes discharged included ammonium perchlorate, TNT-washwater, and isocyanates. The explosive-related wastewater that was discharged is described as a water/explosive slurry. It was generated when equipment used to produce explosives was washed. The labs also discharged TNT contaminated water known as "pink water." Pink water reportedly breaks down to nitrates and toluene and is highly adsorbed and biodegraded in the soil. As determined in Chapter 5, the total volume of wastewater discharged to drainage ditches was approximately 14,150 gallons per day. The wastewater contaminants generated by each lab building are listed in Chapter 5.



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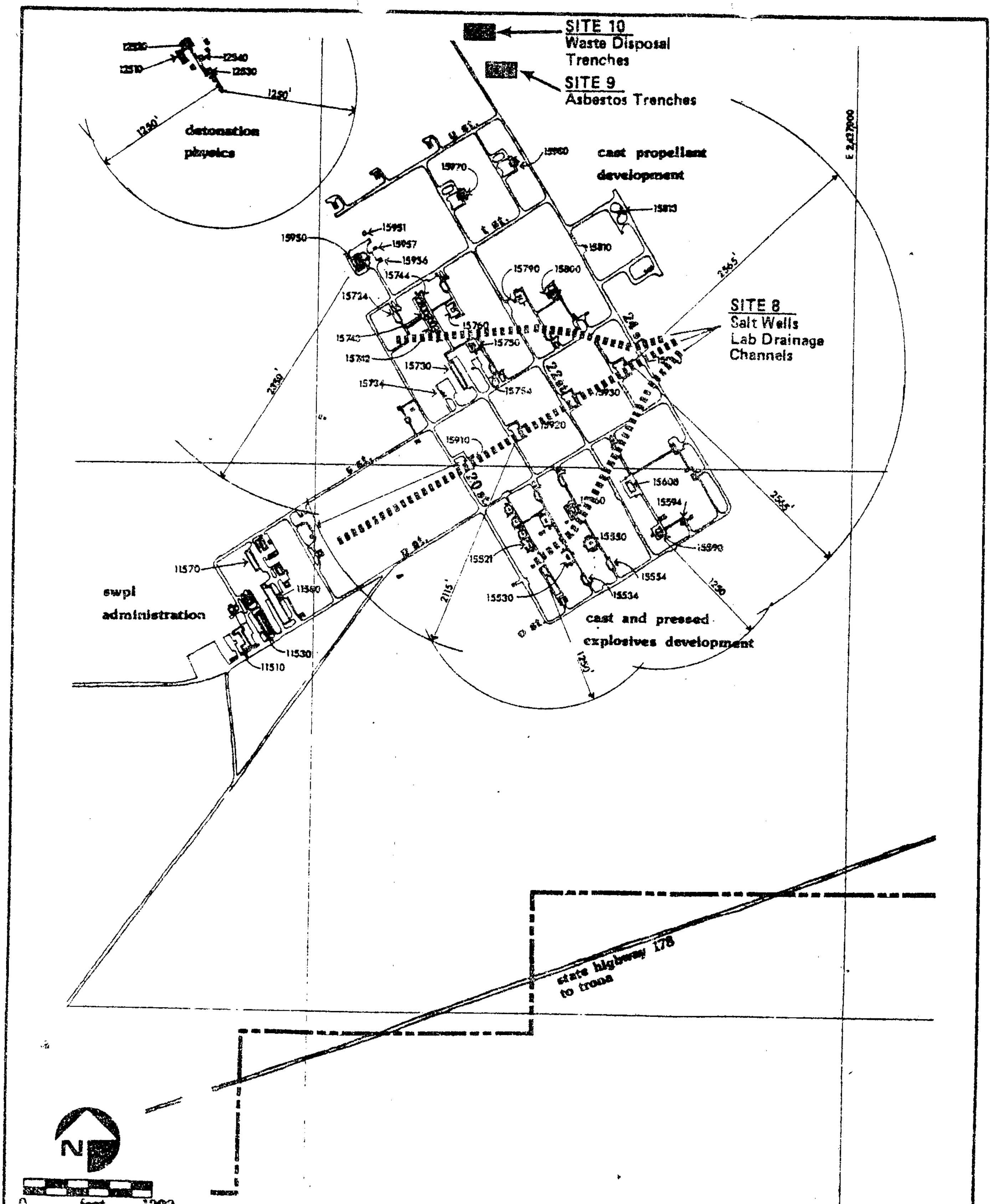
Base Administration and Lab Area Disposal Sites

FIGURE 8-3



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Salt Wells Propulsion Lab (SWPL) Disposal Sites

FIGURE 8-4

Both ground and surface water flow northeast to east toward the center of Salt Wells Valley. According to ERTEC (1983), if a hydrologic connection exists between Indian Wells Valley and Salt Wells Valley, ground water at the site could be as shallow as 50 feet. If no connection exists, water could be deeper than 150 feet.

It is assumed that the ground water is relatively deep and migrating towards Salt Wells Valley and eventually to Searles Lake. The water quality in these areas is very poor; reportedly total dissolved solids is as high as 20,000 parts per million. Therefore, if contaminants reached the ground water, migration to Salt Wells Valley would not be a problem since this area is not used as a potable water source nor would it threaten an endangered species.

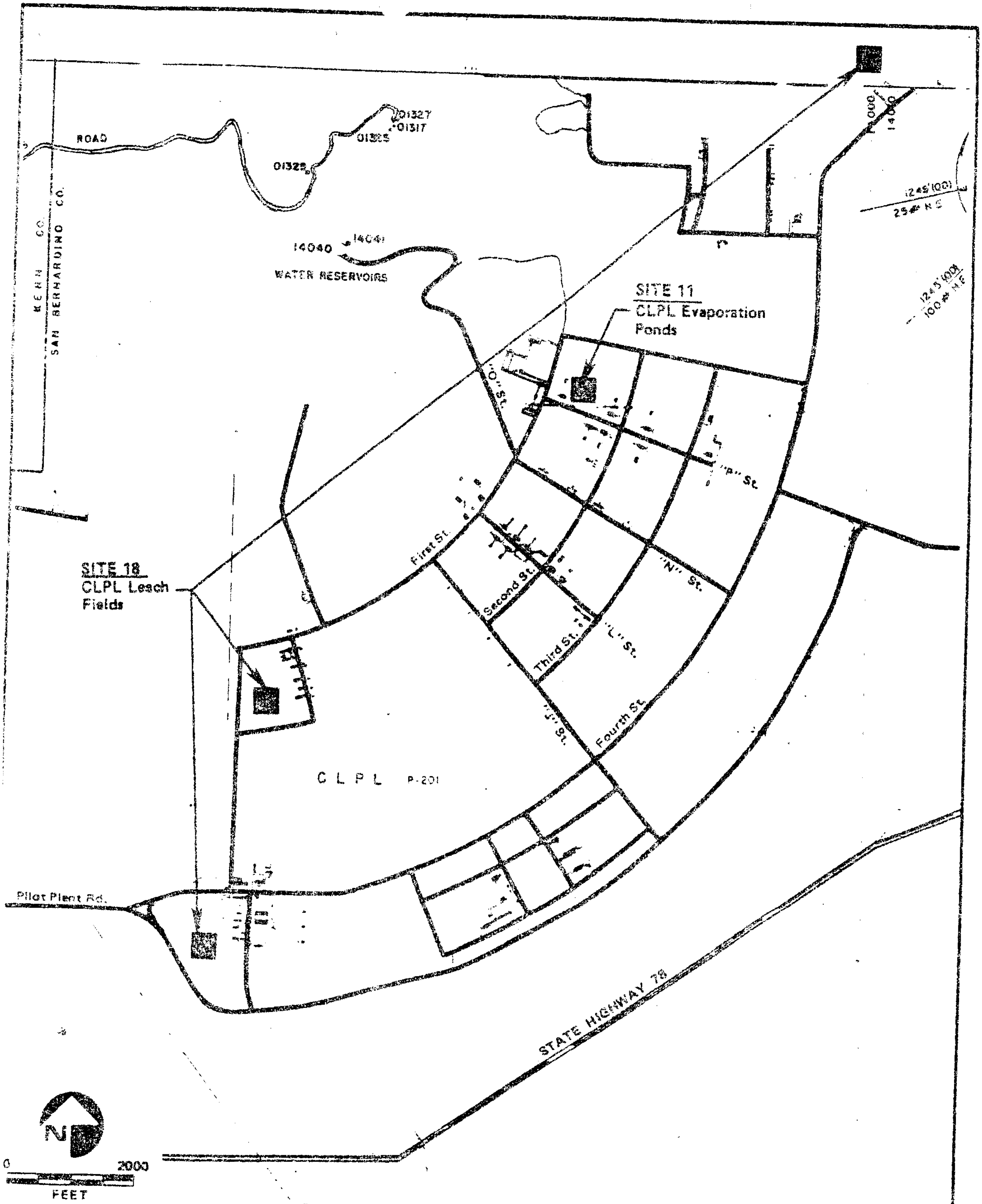
8.9 SITE 9, SALT WELLS ASBESTOS TRENCHES. From 1979 to 1981, waste asbestos was buried in three slit trenches in an area north of Salt Wells Labs (see Figure 8-4). The trenches measured approximately 50 feet long by 10 feet wide and 10 feet deep. It has been estimated that approximately 300 cubic yards of asbestos was disposed of at this site over the 2-year period. Asbestos brought to this site was generated by all NAVWPNCEN activities. Some asbestos was contained in plastic bags, however, much of the waste was loose and buried without protection. The trenches were closed (and filled) in 1981.

The ground water flow characteristics of this site is similar to Site 8. Asbestos is the contaminant of concern and the potential for migration of asbestos to the ground water is very low. Airborne asbestos would be a threat to human health but burial has eliminated that potential problem.

8.10 SITE 10, SALT WELLS DISPOSAL TRENCHES. From 1960 to 1980, all solid waste and some liquid wastes generated by the Salt Wells Lab and China Lake Propulsion Lab areas were disposed of in 10 slit trenches north of the Salt Wells Lab area. The trenches measured 100 feet long by 12 feet wide and 8 feet deep (see Figure 8-4). The waste consisted of lab solid wastes, empty cans and barrels, construction debris, wood, used metal equipment, and some solvents such as TCE and liquid chemicals. Total volume of wastes is estimated at approximately 2500 cubic yards.

The ground water flow and contamination migration characteristics for this site are similar to Site 8. The potential for contaminant migration to the ground water is minimal. If contaminants did reach the ground water, migration to Salt Wells Valley would not result in a threat to a potable water source or human health and the environment.

8.11 SITE 11, CHINA LAKE PROPULSION LAB (CLPL) EVAPORATION PONDS. Wastewater generated by CLPL Buildings 10570 and 10580 was discharged to two unlined evaporation ponds. The ponds were built in 1946 and were located just east of each building (see Figure 8-5). Propellants, AP, and RDX were reportedly machined in these buildings (Dodohara and Davis, 1979). Dust from the operation was separated by a water-aspirated vacuum system. The wastewater was discharged to the ponds. Wastewater contaminants include RDX and AP washwater, and some powdered metal from the propellants such as aluminum. The volume of discharge is not known. In 1981, the ponds were replaced with new clay-lined ponds at the same locations.



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NAVWPNCEN, CHINA LAKE

China Lake Propulsion Lab (CLPL) Disposal Sites

FIGURE 8-5

Ground water in the area of CLFL evaporation ponds appears to be near a divide. Depending on the location of the divide, the flow direction of the potential contaminant migration path can either be northeast towards Salt Wells Valley where there are no known receptors or south and west towards Indian Wells Valley. If the contaminant flow was towards the Indian Wells Valley, there is a potential for ground water contamination problems. However, the depth to water is between 100 and 300 feet below land surface and the nearest water supply wells are about 6 miles away. As the depth and distance is so great, there is a high potential for most of the contaminants to be adsorbed, attenuated and dispersed. Using the aquifer parameters discussed in Chapter 4 would indicate that contamination would take more than 300 years to reach the well supplies.

8.12 SITE 12, SNORT ROAD LANDFILL. From 1952 until 1979 some NAVWPNCEN solid waste went to the SNORT Road Landfill disposal site. The site is located on the south side of SNORT Road on the way to the SNORT Track (see Figure 8-3). Public Works records show that approximately 100 tons a year of solid wastes were delivered to the site. The wastes included tree trimmings, construction debris, cans and barrels, small electrical parts, plastics and rags. No household garbage was disposed of at this site. Evidence suggests that some hazardous wastes were also disposed of including solvents such as TCE, waste oils, liquid chemical wastes and some PCBs from small capacitors. However, the volume of hazardous-type wastes could not be determined.

The SNORT Road Landfill is in a sensitive ground water area as seen on Figure 8-1. It is on the south side of the China Lake Barrier and therefore ground water migrates in a southerly direction toward the public water supply wells in Ridgecrest. The site is less than 3 miles from these wells. As there is major pumping from these wells, the hydraulic conductivity must be greater than the values for the Armitage Field area. It can be assumed that the hydraulic conductivity is greater than 1000 gallons per day per square foot (gpd/ft^2). As the gradient is about 0.001 in this area, the velocity of ground water flow may be as high as 200 feet per year. This indicates a travel time of contaminant migration to the water supply wells to be about 80 years or less.

8.13 SITE 13, OILY WASTE DISPOSAL AREA. From about 1965 to 1980 waste oils were disposed of in two unlined trenches located east of the sewage treatment plant and north of Knox Road (see Figure 8-3). The trenches measured about 100 feet long by 10 feet wide and 5 feet deep. The trenches were used only for oily liquid wastes which may have included motor oils, solvents such as TCE and grease from grease traps at cafeteria facilities. It has been estimated that approximately 10,000 gallons of oily wastes were disposed of over the 15-year period. The site was filled in and closed in 1980.

The oily waste trenches are on the north side of the China Lake Barrier and historically would migrate toward the G-1 and Lark seeps. However, because of ground water recharge from the sewage treatment evaporation ponds (see discussion in Chapter 4) some of the shallow ground water flow may be shifting to the south. It has been reported that shallow ground water, which is at a depth of 20 feet or less, can flow past the barrier and onto the south towards the water supply wells (see Figure 8-1). However, there is no convincing evidence that this is occurring.

It is more likely that oil from the trenches may have formed a product which is now floating on top of the ground water. Both the product and its soluble compounds may be migrating north towards the seeps. If the velocities discussed in Chapter 4 for Armitage Field are similar to the oil in ground water movement here, then migration to the seeps would take less than 100 years.

8.14 SITE 14, ER RANGE SEPTIC SYSTEM. The ER Range Septic System was once the nucleus of five septic tanks and one leach field located 1500 feet directly southwest of Building 31436. The point of generation or source of contamination included the Anti-Radiation Laboratory Buildings 31434 and 31440, and the Thompson Laboratory Buildings 31433 and 31439. The old septic system location is depicted in Figure 8-6.

The five septic tanks of this system became operational in 1950 and were abandoned in 1981. The type of waste received at the site consisted of etching, cooling tower, and sanitary wastewater. The estimated total flow of wastewaters was 11,330 gallons per day of which 30 gpd was etching wastewater. Thus, assuming 260 work days per year and 31 years of discharge nearly 0.25 million gallons of etching contaminated wastewater was discharged to the soil.

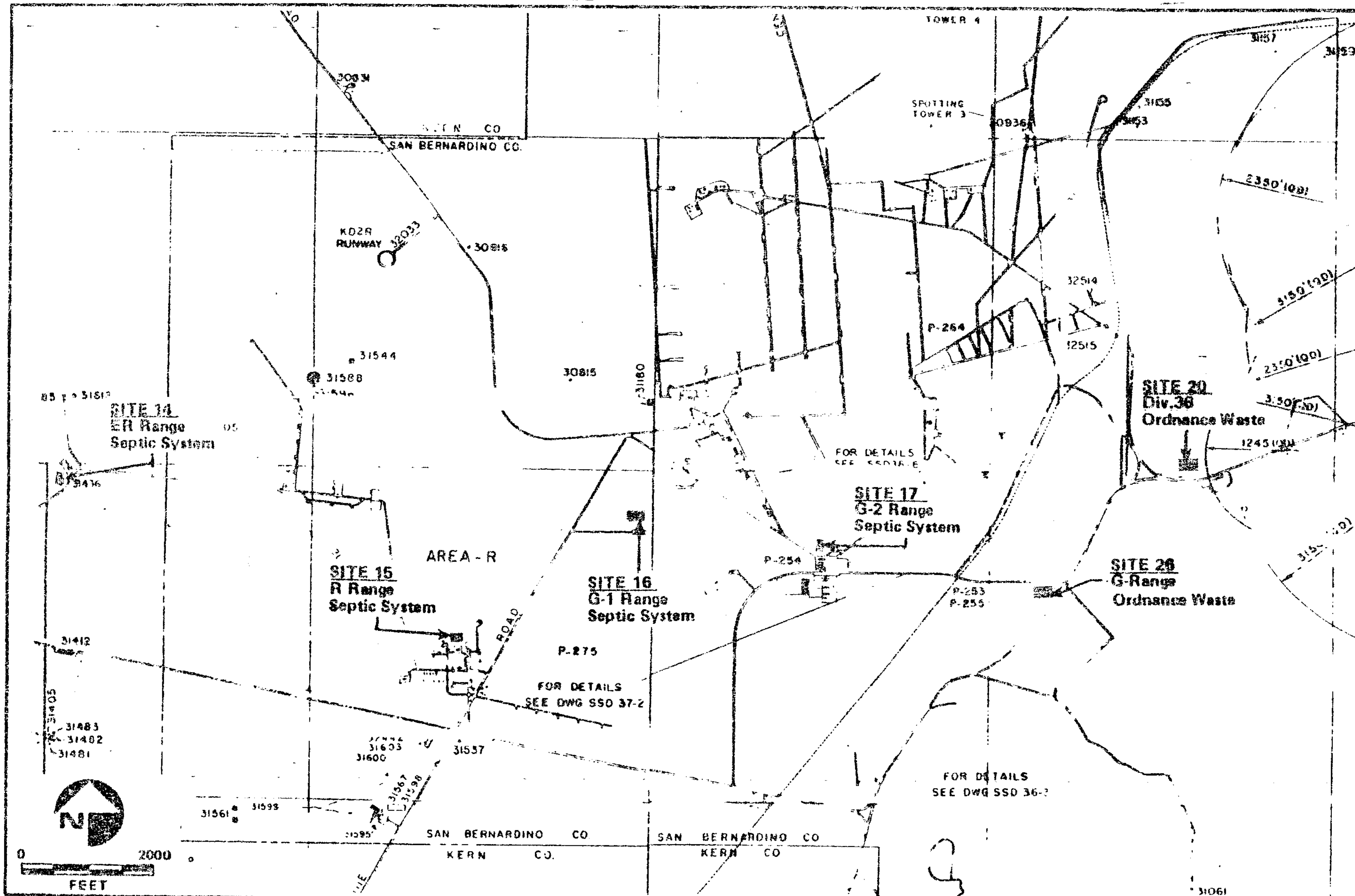
The depth to water for this area is shallow, about 10 feet below land surface. Contaminants from this site will migrate in a northerly direction towards the G-1 seep which is less than 1 mile away. The contaminants vary in mobility from high to low. As the gradient is steep in this discharge area, the velocity of ground water may be about 200 feet per year (see Chapter 4). Therefore, it would take on the order of 10 years for contaminants to reach the seep receptor.

8.15 SITE 15, R-RANGE LEACH FIELD. The R-Range Leach Field was the nucleus of 5 septic tanks that were located 1100 feet north-northeast of the intersection of Water and Pole Line Roads. The R-Range Leach Field site is shown in Figure 8-6. Between 1950 and 1980, this site received sanitary waste as well as dilute solvents. The wastes reaching the R-Range Septic System site were generated by all buildings of the R-Range complex. In addition, the Earth and Planetary Science Building 31598, and Building 31504 were also sources from which the wastes originated. The estimated total flow of these wastewaters to this site was 9530 gallons per day of which 60 gpd was solvents and photo lab wastes. Therefore, nearly 0.5 million gallons of contaminated wastewater was discharged at this site.

Site 15 is also in the China Lake Playa's drainage system as shown on Figure 8-1 and therefore the potential for contaminants to migrate from this site to the G-1 seep is similar to Site 14. It is estimated that the time of travel for these contaminants to reach the seep will be less than 10 years.

8.16 SITE 16, G-1 RANGE SEPTIC SYSTEM. This site is located 1500 feet east from the intersection of Tower and Pole Line Roads. The G-1 Range Septic System site is shown in Figure 8-6. The septic system site included 12 septic tanks abandoned in 1981 after having been in use since 1950. It is unknown how many leach fields were used to serve the 12 septic tanks.

The type of waste material received at this site included sanitary and photo lab wastes. The maximum flow of sanitary wastes was 1800 gallons per day. The maximum daily flow of wastewaters from the photo lab was 30 gallons per day.



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Range Area Disposal Sites

FIGURE
8-6

Therefore, it can be estimated that approximately 0.25 million gallons of photo lab contaminated wastewater was discharged at this site. The sanitary wastes were generated by several buildings in the G-1 Range complex and the photo lab wastes were generated by the operations in the Telemetering Building 30881.

The potential for contaminants to migrate from the site is similar to Sites 14 and 15. Migration is toward the G-1 seep. It is estimated that the time of contaminant travel from the site to the G-1 seep will be less than 10 years.

8.17 SITE 17 - G-2 RANGE SEPTIC SYSTEM. This site is located 200 feet directly north of the Explosive Ordnance Disposal unit Building 30994. Location of the G-2 Range Septic System site is shown in Figure 8-6. The septic system site included three septic tanks and apparently one leach field that received wastes from 1950 until their abandonment in 1981.

The waste materials generated at this site were mostly sanitary wastes and some explosive and photo lab wastes. The estimated total flow of all wastes to the site is 4600 gallons per day of which 100 gpd was explosive and photo lab wastes. Therefore, about 0.75 million gallons of wastewater contaminated by explosives' residues of unknown type and photo lab wastes were discharged over 31 years. These waste streams ae expected to be contaminated by various metals (OESO, 1984).

This site is also in the Playa drainage system as seen on Figure 8-1. Therefore, the potential for contaminants to migrate from this site to the G-1 seep is similar to Sites 14-16. Migration time to reach the seep is expected to be less than 10 years.

8.18 SITE 18, CHINA LAKE PROPULSION LAB (CLPL) LEACH FIELDS. The CLPL Leach Fields site incorporates three abandoned septic tanks with three separate leach fields located as follows: one located in the old China Lake Administration area just south (40 feet) of Building 105; one located at the old China Lake experimental line just west (40 feet) of Building 304; one located at the old China Lake static firing area, approximately 2000 feet north-northeast of Building 217. Location of the CLPL Leach Fields site is depicted in Figure 8-5. The CLPL Leach Fields became operational in the early 50s and their use was discontinued in 1981. Waste materials discharged to the system included phosphates, sulfides, dilute explosives such as RDX and TNT, TCE, oil, grease, ammonia, dilute propellants, and photo lab waste chemicals. Wastewaters containing these contaminants were discharged to the leach fields at a rate of about 7500 gallons per day.

The potential for contaminants to migrate from this site is similar to Site 11, CLPL Evaporation Ponds. However, the concern is even less, as these leach fields did not have constant head of water as did the evaporation ponds. Depth to water is 100 to 300 feet and the nearest water supply wells are 5-6 miles away. There is a high potential for attenuation through adsorption, dilution, and dispersion.

8.19 SITE 19, BAKER RANGE WASTE TRENCHES. From 1944 to the present, range waste from Baker Range was disposed of in one long trench located about 1500 feet south of the B1 Range buildings (see Figure 2-2 in Chapter 2). This site was one of the largest open disposal sites at NAVWPNCEN. The trench measured

450 feet long by 25 feet wide and about 10 feet deep. The range wastes consisted of range target debris, wood, scrap metal, tires, plastic, construction debris, electronic parts and concrete. It has been estimated that approximately 3000 cubic yards of solid wastes was disposed of at this site. No toxic or contaminated wastes were identified as being disposed of at this site.

Ground water is flowing easterly from this site toward China Lake Playa, which is over 11 miles away as shown on Figure 8-1. The major production wells which are not in the direction of flow, are over 9 miles away. In addition, the depth to water is estimated to be greater than 50 feet therefore the potential for unknown contaminants to migrate from this site to a receptor is minimal.

8.20 SITE 20, DIVISION 36 ORDNANCE WASTE AREA. From the late 1960s to 1979 range wastes and ordnance-type waste from the Division 36 area were disposed of in two slit trenches (see Figure 8-6). The material disposed of included typical NAVWPNCEN range wastes such as construction and target demolition debris, concrete, steel and wood, as well as bomb casings and other solid wastes. Total volume of wastes has been estimated at approximately 600 cubic yards. The site was closed and filled in 1979. The site contains inert wastes and therefore has no potential for contaminant migration.

8.21 SITE 21, CT-4 DISPOSAL AREA. Between 1956 and 1979, residual materials from special weapons testing in the CT Ranges were disposed of in a small open ditch at the end of the CT access road (see Figure 2-3 in Chapter 2). The ditch measured 200 feet long by 50 feet wide and 10 feet deep. Disposal waste included PEP materials, depleted uranium, radium dials, wood, concrete, metal, plastics, cans and barrels some of which contained residual chemicals, solvents and oils. Not more than 100 pounds of solid waste were disposed of each week. Total volume of wastes buried is estimated at 2000 cubic yards.

Ground water is at a depth of about 100 feet (Ertec, 1983) and the migration path is toward Salt Wells Valley. The potential to migrate to Salt Wells Valley is low and this pathway does not lead to a useable water source or a sensitive environmental resource.

8.22 SITE 22, PILOT PLANT ROAD LANDFILL. From 1944 to 1965 a majority of NAVWPNCEN domestic solid waste generated by the Navy Housing and Public Works was disposed of in 12 large trenches located just north of Pilot Plant Road and 1 mile west of the China Lake Propulsion Lab entrance (see Figure 8-3). In addition to the domestic wastes, pesticide containers (some still containing liquid pesticides) and barrels partially filled with oil and solvents, such as TCE, were disposed of in these trenches. Reportedly, some paints and thinners were deposited. Quantities could not be determined. Usually three slit trenches were open at a time and while one was being filled, the others were set on fire and allowed to burn through the evening. At the time when each trench was closed, it usually measured 200 feet long by 30 feet wide and 15 feet deep. It has been estimated that 110,000 cubic yards of waste material were disposed of in the 12 slit trenches by the time the area was closed in 1965.

This site is in a sensitive area in relationship to ground water flow as seen in Figure 8-1. It is south of the ground water barrier in an area where the shallow confining layer may be non existent. Therefore, any contaminants from the landfill may enter the main aquifer and migrate toward the water supply wells. The site is less than 3 miles from the well field. The main aquifer probably has a hydraulic conductivity greater than the upper aquifer and therefore, contaminants may migrate more quickly in this aquifer.

8.23 SITE 23, K-2 SOUTH DISPOSAL AREA. Between 1951 and 1981 range wastes were disposed of in three (3) slit trenches located in the K-2 range area (see Figure 2-2 in Chapter 2). Range wastes included construction and demolition debris, bomb casings, concrete, wood, and metals. More importantly was the one-time disposal of approximately 17,000 gallons of chlordane at this site. This chlordane disposal was part of a larger chlordane disposal event that also included the C-1 East Disposal Area (Site 29). Source of the chlordane, which was in one and five gallon metal containers, was reportedly from a Navy installation at Barstow, California. The event was reported to have occurred in the 1970s. This disposal site was closed in 1981.

The potential for migration from this site to any water supply wells is low as the site is over 9 miles from the nearest well field and will instead flow to the China Lake Playa discharge area as seen on Figure 8-1. The contaminant of interest, chlordane, is not very mobile as discussed in Section 4.5. It cannot migrate across the Playa to the nearest receptor of interest which is the G-1 seep containing the endangered Mohave chub.

8.24 SITE 24, K-2 NORTH DISPOSAL AREA. Between 1950 and 1981, range wastes like those described above for K-2 South where disposed of in two slit trenches located in the north end of the K-2 Range (see Figure 2-2 in Chapter 2). Approximately 1000 cubic yards of waste materials are estimated to have been buried at the site. The material deposited at this site is considered inert and, therefore, no contaminant migration is expected.

8.25 SITE 25, G-2 RANGE DISPOSAL AREA. Between 1944 and 1958 inert range wastes were buried in three slit trenches in the G-2 Range area (see Figure 2-2 in Chapter 2). The trenches measured 100 feet long by 8 feet wide and 6 feet deep. Total volume of range-type wastes is estimated at 600 cubic yards. The type of range wastes are similar to that described for Site 19 and 20. As the material disposed of at this site is considered inert there are no contaminants of concern.

8.26 SITE 26, G-RANGE ORDNANCE WASTE AREA. Between 1950 and 1979, range wastes, such as concrete rubble, metals, bomb casings, and wood, were disposed of in two slit trenches on the north end of G Range (see Figure 8-6). Volume of waste was about 500 cubic yards total. Each trench measured 100 feet long by 8 foot wide and 6 feet deep. The material disposed of at this site is inert; therefore, no contaminants of concern have been identified.

8.27 SITE 27, NAF DISPOSAL AREA. From 1945 to 1978, a large majority of the solid and liquid wastes generated by aircraft operations were disposed of in two or three trenches located 0.5 mile west of the (Armitage) Naval Air Field (NAF) (see Figure 8-2). Waste materials included empty and partially full paint and solvent cans, old engine parts (non-salvagable) and the Group 3 wastes such as wood, concrete, metal, paper, rags, etc. More than 2000 cubic yards of wastes were disposed of in these 100-foot long trenches during the 33-year period.

The potential for migration of contaminants from this site is very similar to the other Armitage Field sites (see discussion of Site 1). The flow of contaminants will be toward the China Lake Playa and the seeps (as shown on Figure 8-1). In addition, Well 7A is within 0.5 mile of the site. This well is presently not in use but it was used in the past and may still be used for irrigation and public supply. Therefore, there is potential for contaminants to migrate toward the well if it is pumped in the future.

8.28 SITE 28, OLD DPDO STORAGE YARD. From about 1965 to 1970, a Defense Property Disposal Office (DPDO) was located on Iwo Jima Road (see Figure 8-2). The only wastes that may contaminate this site are PCBs from used, leaking transformers and capacitors. However, no information was obtained regarding any actual PCB spills or whether transformers stored onsite actually leaked. No information is available regarding the number of transformer stored or the location on the DPDO site where they may have been stored. The old DPDO site was moved in 1970 to the present DPDO location. There currently is no visible evidence at the DPDO site of any spills and the site has essentially reverted back to a desert habitat. There is no evidence of PCB spills at this site.

8.29 SITE 29, C-1 EAST DISPOSAL AREA. From the 1950s to the late 1970s, range waste, live ordnance and chlordane have been disposed of in a series of three trenches located 1000 feet east of the C-1 Tower (see Figure 2-2 in Chapter 2). Site surveys and interviews have substantiated the one-time disposal of approximately 17,000 gallons of unused concentrated chlordane by burial sometime in the 1970s. Remaining (in 1 and 5-gallon metal containers) on the surface of the site are still several pallets of full chlordane cans. Specifications off of the chlordane can label showed that the content was 2 percent technical chlordane (consisting of octachloro -4,7 methane, tetrahydroindane and related compounds) together with 98 ~~percent kerosene~~. It was also reported that approximately 4000 gallons of lead-based paint in 1- and 5-gallon cans was buried at this site. Other wastes in the form of solvents and oils were disposed of in lesser quantities. The C-1 East site is also reported to contain live ordnance that was hauled in off of the ranges. Signs are posted at several points warning "Do not dig-live ordnance buried." The volume or the type of ordnance buried could not be determined except that it has been reported that a significant quantity of flare primer cord was disposed at this site. The site trenches were closed in the late 1970s and currently used radar equipment parts are stored on the site surface. It should be emphasized that the C-1 Range East Disposal Area is immediately adjacent to and bounded by two impact/target areas. The distance of the disposal area from either of the two impact/target areas is approximately 1000 yards.

It is highly unusual that live ordnance may be intentially disposed of by burial. It is generally accepted that impact and target areas owned by the U.S. government, operated by U.S. Forces, and subjected to live bombing runs will never be turned over to the civilian authorities. For that reason, these impact/target areas are normally always off limits to "all personnel" except for EOD personnel that may enter these areas to recover, render safe, or destroy-in-place dudded ordnance ammunition, munitions, and devices. EOD units diligently seek to locate unrecovered live ordnance in instances where such recovery lends itself to evaluating in the research, development, testing and evaluation (RDTE) effort. However, in the case of the C-1 Range East Disposal site, EOD recovery operations may not have been justified in view of the very close proximity of the site to the two known existing impact/target areas and in view of the possibility that no need for evaluation existed. Thus, it may have been more economical to bury "in (or near) place."

The potential for contaminant migration from this site to sensitive areas such as the major public water supply well fields and the seeps near the China Lake Playa is low. As seen on Figure 8-1, the site is outside the zone of migration towards the seeps. The large well fields and Playa are over 9 miles from the site. However, there is a water well (W-22A) seen on Figure 8-1 within 0.25 mile of the site. It is used for irrigation and potable water supply. The contaminant of interest is large volumes of chlordane. Chlordane has a low potential to migrate as it is highly adsorbed on soils. However, as chlordane is considered very hazardous and pumping may draw contamination towards the well, further analysis needs to be carried out to determine the potential to reach the receptor.

8.30 SITE 30, C-1 RANGE WEST DISPOSAL AREA. From the 1950s to the late 1970s, range waste (such as concrete, wood, metal, and bomb casings) and reportedly some live ordnance were disposed of in two slit trenches located west of the C-1 Range Tower (see Figure 2-2 in Chapter 2). The live ordnance waste disposal is similar to that described for Site 29, C-1 East. The volume or type of live ordnance could not be determined by the IAS team.

The physical setting of this site is similar to Site 29. The wastes are inert and, therefore, no contamination migration problem exists. Live ordnance contamination occurs in the area and access is properly regulated. No immediate threat to human health on the environment is evident.

8.31 SITE 31, PUBLIC WORKS PESTICIDE RINSE AREA. From 1945 to 1980, contaminated pesticide and herbicide rinse water and some concentrated solutions of pesticide and herbicide were spilled on the ground in an area south of 7th Street behind the public works area (see Figure 8-3). Some of the chemicals used were Malathion, Diazanone, DDT, Chlordane, Vapoma, 2-4-D, 1-2-4-D, and 1-2-4 T. Pest and weed control operations were conducted on base by an outside contractor. Volumes of pesticide or herbicide spilled over the life of the operation are difficult to ascertain. However, the IAS was able to determine that as much as 2000 gallons of mixing and rinsing waste water may have been drained onto the soil each year. The concentration of pesticides in the rinse water was probably less than 1 percent by volume. Therefore, over 35 years as much as 700 gallons of pesticide may have been discharged to the soil. This mixing practice was discontinued in 1980 when a concrete-lined drainage pad was installed on this site. The pad now drains the rinsewater to an underground holding tank.

This site is located over the main aquifer within 1.5 miles upgradient of the public water supply well field as seen on Figure 8-1. Therefore, the potential of contaminant migration to this well field is high. It is estimated that it would take about 40 years for contaminants to reach the receptor.

8.32 SITE 32, GOLF COURSE PESTICIDE RINSE AREA. From the mid 1960s until about 1980, pesticide mixing and some rinsing of pesticide containers and equipment were also done at the Golf Course site (see Figure 2-3 in Chapter 2). Reportedly, this site was used only half as much as Site 31 so, perhaps, 1000 gallons per year of wastewater were spilled. Over 15 years, assuming 1 percent is pesticide, about 150 gallons of pesticide were discharged to the soil.

As seen on Figure 8-1 this site is in a similar physical setting as Site 13, Oily Waste Trenches. Therefore, contaminants may migrate north 2-3 miles toward the G-1 and Lark seeps. There is also a possibility, due to man-made recharge, that the direction of ground water flow can change in the shallow aquifer. If this does occur, contaminants can migrate south 3-4 miles toward the well field in Ridgecrest. Therefore, in either case the migration pathways lead to a receptor.

8.33 SITE 33, MICHELSON LABORATORY DRY WELLS. From the late 1950s to the 1970s Michelson Lab had floor drains in auxiliary or backup power rooms which led to four unlined dry wells. Backup power consisted of large storage batteries. Occasionally batteries were drained or fluids were spilled such that battery acid would enter the drains and thus be directed to the dry wells. The wells were located between the east wings of Building 00005 (see Figure 8-3). Three of the four wells have been filled in and the fourth is no longer in use. Specific quantities of battery acid drained to the wells could not be determined, however, it was reported to the IAS team as being very small quantities, probably less than 10 gallons per year. The research effort did not indicate any reason to suspect that the wells were used for any other disposal purposes. The potential for small amounts of acid contaminants to migrate through the soil is low as described in Section 4.5. Therefore, migration to a receptor from this site is not expected.

8.34 SITE 34, LAURITSEN ROAD DISPOSAL AREA. From 1944 to the 1950s, solid wastes were disposed of in several trenches on the north side of Lauritsen Road (see Figure 8-3). The trenches measured 100 feet long by 15 feet wide and 10 feet deep. Solid waste was composed mainly of Group 3-type wastes such as construction debris, wood, concrete and metal. Some liquid wastes including TCE, lab chemicals, waste oil containers and partially full pesticide containers were disposed of at this site. It has been estimated that about 2000 cubic yards of material had been disposed of over the life of the site.

This site is located just north of the China Lake barrier as seen on Figure 8-1. However, as mentioned previously a new ground water recharge zone may cause a potential for contaminants entering the shallow aquifer to migrate either north toward the G-1 seep, or south to the major well fields. Time of travel would be less than 100 years.

8.35 SITE 35, SNORT TRACK ACCIDENT. The SNORT Track Accident is a site where an incident involving the accidental release of Beryllium occurred. The site is located along the SNORT Track 3000 feet from the breach end (see Figure 2-3 in Chapter 2). This site is estimated to be 10 foot wide by 10 foot long. The accident occurred in 1961. The accident occurred when approximately 4 pounds of Beryllium used as a propellant for a 155 mm projectile was released when the projectile detonated accidently in the gun. The dust residue and associated contaminated materials were cleaned up and buried at the site.

The depth to water at this site is about 100 feet below land surface. Beryllium does not migrate readily through the soil as described in Section 4.5. With the small amount of residue material buried, migration of contaminants from this site to a receptor is not likely.

8.36 SITE 36, SNORT STORAGE SHEDS. The SNORT storage sheds are located 1700 feet directly southwest of the SNORT Track breach. Approximately 10 small buildings occupy this site. They include Buildings 25021, 25009, 25028, 25008, 20100 and 30976 (see Figure 2-3 in Chapter 2). The buildings cover an area which is approximately 500 feet by 500 feet. The SNORT Storage Sheds received various hazardous wastes from 1956 to 1962. It was reported to the IAS team that during this period a number of liquid hazardous materials were spilled onto the ground. The materials included red fuming nitric acid, unsymmetrical dimethyl hydrazene, furfal alcohol, and analine. Throughout the period of operations (6 years), it is estimated that approximately 300 gallons of the hazardous wastes were spilled. It is expected that 70 percent of these chemicals volatized on the soil surface. The resulting amount of material that was absorbed into the soil was small. The depth to ground water is about 100-200 feet (Kunkel and Chase, 1969) and therefore the potential for contaminants to migrate from this site to the ground water is low.

8.37 SITE 37, GOLF COURSE LANDFILL. The Golf Course Landfill site is located 3700 feet east along Bladed Access Road from its intersection with Graded Access Roads, and then 600 feet south of Bladed Access Road. Location of this site is shown in Figure 2-3 in Chapter 2. The Golf Course Landfill was open from 1945 to 1964. This landfill received its wastes from the general NAVWPNCEN community. Wastes received at the site consisted of wood, concrete, plastics, paper, tree trimmings, and similar general refuse. It is estimated that approximately 1200 cubic yards of these wastes were disposed of at this site over its 19 years of operation. The material disposed of at this site is inert and therefore no contamination problems exist.

8.38 SITE 38, CACTUS FLAT DISPOSAL TRENCHES. The Cactus Flat disposal trenches are located 30 miles northeast of the NAVWPNCEN Administrative area (see Figure 2-1 in Chapter 2). Special test programs conducted in this small remote area resulted in wastes being generated at the area and disposed of in two trenches at the site. The trenches were approximately 50 feet long by 30 feet wide and 10 feet deep and each trench was separated by a distance of 1/2 mile.

The Cactus Flat Disposal Trenches became operational in the late 60s, and use of the trenches was discontinued in 1979 when they were closed and filled. The type of wastes disposed of at the site consisted of wood, cans, concrete, rubber tires, and metal casings. It is estimated that approximately 1000 cubic yards of wastes were disposed of over the approximately 10 years that the site was operational. The material disposed of at this site was inert and therefore no contamination problems exist.

8.39 SITE 39, CGEH-1 GEOTHERMAL WASTE. In the mid 1970s, geothermal drilling muds and liquid (oily) wastes were disposed of in an open pit adjacent to geothermal drilling operations. The site was located in the northern section of NAVWPNCEN (see Figure 2-1). Volume of wastes could not be determined. The site was closed in 1979 in accordance with Regional Water Quality Control Board guidelines. Ground water was not encountered while drilling geothermal wells to

3000 feet. Due to the depth of ground water and the procedures used for closure, the migration potential of geothermal waste contaminants is very low.

8.40 SITE 40, RANDSBURG WASH #1. From the mid 1950s to the mid 1970s solid waste materials from Randsburg Wash operations were buried in three slit trenches. This site is located about 1 mile north of the administration area near the Canon benchmark (see Figure 2-4 in Chapter 2). Each trench was about 12 feet wide by 70 feet long and 10 feet deep. From the mid 1950s to the mid 1970s. Wastes deposited include primarily ordnance type waste such as shell casings and fuzing. In addition, lumber, rope and scrap metal is still visible in one trench. There is no evidence that liquid or hazardous wastes were deposited in these trenches. The material disposed of at this site is inert and, therefore, no contamination problems exist.

8.41 SITE 41, RANDSBURG WASH #2. Two large disposal pits about 0.75 miles northeast of the administration area were the main disposal sites at Randsburg Wash from the early 1950s until their use was discontinued in 1980 (see Figure 2-4 in Chapter 4). The pits were about 75 feet by 100 feet by 20 feet deep. The waste received included general refuse from the area such as wood, construction materials, paint cans, glass and plastics. Due to the electronic research at Randsburg Wash a significant amount of waste (3 cubic yards week, 1080 cubic yards/30 years) from the electrical shops, such as wire, transistors, and small capacitors, were deposited in the disposal pits. Also, the machine and mechanical shops reportedly disposed of some waste cleaners, solvents, and oils such as TURCO, kerosene, acetone, and used motor oil. The quantities have been estimated to be 2000-3000 gallons of waste oil and a similar quantity of solvents during the life of the disposal pits. In the 1950s and early 1960s the waste pile was burned regularly so that much of these wastes were volatalized.

There are two water wells used for the potable supply at the Randsburg Administration area which are located about 1-1.5 miles southeast of Site 41. However, the depth to water is 200-250 feet. The transmissivity is only 1000 gallons per day per foot which indicates a migration movement 200 times slower than the China Lake complex. The regular burning of the waste and low transmissivity makes it unlikely that contamination will reach the ground water. In addition, the groundwater movement is suspected to be towards the northwest away from the water well receptors.

8.42 SITE 42, RANDSBURG WASH #3. A past disposal site for fuel drums is located about 20 miles east of the administration area, just north of Randsburg Road at the Fath benchmark (see Figure 2-4 in Chapter 2). This disposal site consists of a pit about 30 feet by 30 feet by 4 feet deep which was utilized for the one time disposal of about thirty 55-gallon drums of fuel (type unknown). The fuel was burned in the drums so that only the empty drums remain. Some are partially buried. There is also an abandoned amphibious vehicle at the site. The burning took place in the mid-1970s and the site has not been used for any other subsequent disposal. There is no visible evidence of spilled fuel on the ground. Therefore no contamination of this site is documented.